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XI. *The life history of lakes.*—After a consideration of the various causes which may bring the life of a lake to an end, the history of a few of the principal lakes of France is sketched. The level of Lake Geneva has been lowered about 30 meters since the glacial time. It had one stationary level between the highest and the present levels, when the water stood 10 meters higher than now. The other lakes especially considered are Bourget, which has also been lowered in post-glacial time, and d'Annecy, which was formerly 15 meters lower than now. The rise was occasioned by alluvial deposits in the valley of the Fier, to which the outlet of the lake flows. These deposits have dammed the exit. The history of Lacs de Saint Point and Remoray—in the Juras—is also outlined, the interesting point being that they were formerly one lake, now divided into two by the growth of a delta completely across the narrow basin. The growth of deltas seems to have played a large part in the history of many of the mountain lakes. This is the natural course of events where torrential streams debouche into the standing water. Many other lakes appear to have had their areas greatly diminished by similar processes. Reference is also made to certain extinct lakes, and the criteria by which their former existence is recognized are briefly given.

The figures in the text of the volume are largely half tones, which unfortunately, cannot be said to be of more than medium grade. It could have been wished also that the few maps of the text which show features other than the topography of the lake bottoms, could have been clearer. On the whole they have so much ink, that it is difficult to find the points sought. It is always a serious problem to make a map clear, and at the same time get a great deal on it, and in this case the difficulty has not been overcome.

R. D. S.

On the Building and Ornamental Stones of Wisconsin. By. E. R. BUCKLEY, Ph.D., Madison, Wis., 1898. Pp. xxvi + 544. Bull. No. 4. Economic Series No. 2 of the Wisconsin Geological and Natural History Survey.

Dr. Buckley's report is one of the most compendious volumes on the subject of building stones published in recent years. Of the three parts into which the subject-matter is divided the first treats of the demands, uses, and properties of building and ornamental stones in general. This is a valuable though brief discussion of the subject.

Part II, which forms the bulk of the volume, begins with a chapter on the geological history of the state, followed by a detailed description of the different quarry-areas. The igneous and metamorphic rocks are first enumerated and described, and the author clearly shows the variety as well as the architectural beauty and value of the granitic rocks of the state. The only metamorphic rock mentioned is quartzite.

The sandstones are divided into three classes, partly on a geographical and partly on a geological basis. The first class includes the northern Potsdam sandstone, comprising what is ordinarily known as the Lake Superior brownstone, which apparently differs quite markedly from the sandstones of the southern Potsdam area and the St. Peter's formation included in the second and third classes. Neat sketch maps show the location of the quarries with reference to the markets and the transportation facilities. The limestone quarries are conveniently divided on a geological basis into (1) the Lower Magnessian, (2) the Trenton, and (3) the Niagara.

Chap. VII relates to the areas from which suitable stone for different uses may be obtained, such as building stone, bridge stone, paving blocks, etc. It has a direct economic bearing that will no doubt be appreciated by architects, builders and dealers in stone.

In the next chapter there is a discussion of the results of physical tests which are conveniently summarized at the end of the chapter in a series of thirteen tables. The crushing strength may really have little significance to the scientist, but has great weight with the architect. In this respect the Wisconsin granites and limestones have shown surprising results. The excess of strength of the Wisconsin granite over that from other states is possibly not so great, however, as the tests might lead one to believe. Granting that Gilmore's formula is incorrect, it is not conclusive proof that a large cube is not stronger than a small one in a ratio greater than the comparative areas of the faces. It might have been better to have given the dimensions of the cubes of the granites tested from other states along with the figures quoted and permit the reader to draw his own conclusions.

One of the most important sections of the report has to do with the effects of freezing and thawing on the strength of building stones. Numerous experiments have been made leading to the conclusion that freezing and thawing, continued for a considerable period, lessen the strength of rock, and that the loss in strength is in a general way proportional to the crushing strength of the rock. In other words, the

loss of crushing strength is greater in rocks in which the porosity is low and the size of the pores small, than in rocks in which the pore space is high and the pores large. This conclusion is diametrically opposed to that which is popularly current. The explanation of this unexpected result is that in the case of rocks where the pores are large the included water is given off with sufficient rapidity to avoid the evils of freezing, while in the case of close-textured rocks which are saturated when frozen, the water does not escape, and the injury to the rock is greater. This is a point of great practical value, as well as of theoretical interest. The results of the experiments are given in detail in tabulated form. Part II also contains a set of tables in which are given the results of the various other physical tests to which the building stones of Wisconsin have been subjected.

Part III is an appendix in which composition, kinds of stone, and rock structures are discussed.

The form of the report is a convenient one, the binding is neat and attractive, the illustrations are numerous and for the most part well chosen. A carefully prepared map of the state is folded in the text. An attractive feature is the representation of the stones in their natural colors. No verbal description could arrest the attention so effectually or give the reader so vivid an idea of the beauty of the stone, as these artistic plates. If the printer is not at fault, however, one might wonder why the beautifully colored granite on Plate XII should be called gray.

The person who can write a perfect report on building stones has not yet attempted it. In Dr. Buckley's report there are some points which some of his readers might wish to change. Some are matters of personal taste and all are of somewhat minor importance compared with the much valuable matter forming the body of the report. Petrographers may not all agree entirely with the distinction between gabbro and diabase (p. 447). Some of the readers may not agree with the relative importance placed upon the different cements in sandstone given on p. 450, or with the conclusions about the use of quartzite on p. 455. All those who might agree with the author that "the joints in igneous rocks are more numerous than in the sedimentary" might not agree with him that it is "owing to the greater length of time through which they have been subject to dynamic action" (p. 459).

The report represents a vast amount of careful and conscientious work on the part of Dr. Buckley and will no doubt prove a valuable

handbook in the stone trade of Wisconsin. While it is prepared primarily in the interests of the stone industry of Wisconsin, it has much of general interest to persons outside of the state, and both Dr. Buckley and the director of the Wisconsin Geological and Natural History Survey are to be congratulated on presenting to the public such an interesting, attractive and valuable contribution on the subject of building stones.

T. C. H.

Irrigation and Drainage. Principles and Practice of their Cultural Phases. By F. H. KING. The Rural Science Series. The Macmillan Company, pp. 502, 8vo. 1899. Amply illustrated.

In this work there is brought together a vast amount of experimental and experiential data relative to the physics of soils and their relations to water and air. These data are given in both their analytical form in the shape of tables, diagrams, and other modes of scientific expression, and in their concrete industrial form as exemplified in growing crops and in drainage and irrigation appliances. The treatment is very clear and specific and at the same time very compact. It is a conspicuous example of *multum in parvo*, if 500 close-set pages do not make the expression inapplicable. The author has personally studied the irrigation systems of Europe as well as those of this country, and has himself conducted careful experiments bearing on the fundamental principles involved. While thoroughly practical in its bearing, the treatment is firmly controlled by the scientific spirit. It is an admirable blending of good science and good technology.

T. C. C.

The Coos Bay Coal Field, Oregon. By JOSEPH SILAS DILLER. Extract from the Nineteenth Annual Report of the U. S. Geol. Survey, 1897-8, Part III, Economic Geology.

This paper deals almost wholly with economic interests of a very local character; and yet it is not without some facts of general interest. It is a description of a coal field of very limited extent situated on the coast of Oregon 200 miles south of the Columbia River. The coal is of Eocene age. Fossils of fresh and brackish water type are found in